Remarks

Claims 1-10 remain in the application. Claim 1 has been amended, and claims 2-10 have been added in order to more clearly define Applicant's invention. The claims as now presented are attached in clean form for the convenience of the Examiner.

The disclosure was found informal, with the Examiner requesting applicant to update the specification on page 1, first paragraph to update the status of the application, including the two continuation applications and the US Patent that has issued thereon. Claim 1 has been rejected under 35 U.S.C. §112, second paragraph, as being indefinite because the word "definable" should be –defined--; and the language "wherein replication" is unclear. Finally, claim 1 has been rejected under 35 U.S.C. §102(b) as being anticipated by Du Hamel et al (US Patent No. 3,079,602. These objections and rejections are traversed and reconsideration is requested in view of the foregoing amendments, and following remarks.

The first paragraph on page 1 has been amended to update the status of the application, including the two continuation applications and the US Patent that has issued thereon.

Claim 1 has been amended to clarify the language of "definable" and "replication".

Finally, the rejection of claim 1 under 35 U.S.C. §102(b) as anticipated by Du Hamel et al. is traversed for the following reasons.

Applicants have revised Claim 1 to make clear the difference between what is claimed and what is disclosed by the Du Hamel *et al.* patent.

Applicants are claiming an antenna system which comprises a fractal antenna. The fractal antenna of the system comprises a first element having a portion that includes at least a first motif defined in at least two-dimensions, said portion further including a first replication of said first motif and a second replication of said first motif, such that a point chosen on a geometric figure represented by said first motif results in a corresponding point on said first replication and on said second replication of said first motif, each at different spatial locations. Each of the replications is spaced from the first motif and geometrically defined by at least one operation set selected from a group consisting of (a) scaling the size of said first motif, (b) rotating said first motif, and (c) translating said first motif. Each operation defining each replication excludes those operations which are a function of and referenceable to the spatial location of a single point on said first motif. The antenna system further includes a conductive

element, spaced-apart from said first fractal antenna to influence at least one of resonant frequency and bandwidth of said antenna system.

The Du Hamel *et al.* patent is naturally based on the understanding of the electrodynamics of broadband and frequency independent antennas in the 1950's and the language of the disclosure and claims is correspondingly restrictive. This allows Applicant to describe a significantly more general geometry in terms of the iterated application of a "motif" (fractal generator) independently of the restrictive geometry described in the Du Hamel *et al.* patent.

In Du Hamel *et al.* an antenna is constructed by the replication along a radial line of a "tooth" or "triangle", in Applicant's language this "tooth" is a motif. The orientation of the tooth in space is not modified as described in any part of the disclosure of the Du Hamel *et al.* patent. The only change in the tooth discussed by Du Hamel et al. is a scaling of tooth size proportional to the distance from a "vertex point" (a spatial location on the antenna which is referenced in each replication operation), yielding an antenna logarithmically periodic from that vertex point. To achieve frequency independent or broadband behavior in the antenna, it was taught in the Du Hamel *et al.* patent that it was necessary that the antenna structure be defined by an opening angle, α, which is a mathematically equivalent way of asserting that the antenna have the teeth growing in proportion to the distance from the vertex point of the antenna. Further, Du Hamel et al. teach that the log periodic scale size distribution is important to the performance of the antenna and do not consider more general scaling principles or self-similarity.

It is now understood mathematically that the Du Hamel et al. geometry is a fractal, but a mathematically degenerate one. More general fractals that are useful antennas may be constructed by applying a broader set of mathematical transformations to a fractal motif and thus obtaining a fractal structure that is not restricted to an opening angle and has more general scaling properties than only log periodic scaling. The restrictions of the Du Hamel et al. geometry are clearly described in their claims 1 through 7.

The mathematical transformations applied to a fractal motif as described by Applicant are translation, rotation, and a multiplicative scaling. These are the elements of a general affine transformation. It is important to note that in Applicant's work the scale factor for scaling of the motif may be independent of distance from a vertex point (indeed fractal antennas constructed by

Applicant's method may not posses readily identifiable vertex points) and thus this antenna geometry is significantly more general than described by Du Hamel *et al.* Thus, while in Du Hamel *et al.* replication operation occurs as a function of and relative to a spatial point in the antenna design of the original motif, i.e., the vertex point, Applicant's claim 1 specifically excludes such a function. In fact, Du Hamel *et al.* are at considerable pains to restrict their geometry to the log periodic scaling law, and thus their patent actually teaches away from the useful geometries uncovered by Applicant. Because the operations defining the multiplicative scaling of Applicant's approach is independent of distance from a vertex point, it is possible for a fractal antenna of Applicant's to "escape" from any specified opening angle defined in another portion of the antenna, or alternatively tend asymptotically to an angle of arbitrarily small size. All this is strictly impossible in the Du Hamel *et al.* construction method.

Claims 2-10 have been added, and contain similar limitations to those recited in claim 1.

In summary, therefore, the remaining claims, claims 1-10, are believed to be patentable. An early and favorable action thereon is therefore earnestly solicited.

Respectfully submitted,

Toby H. Kusmer
Registration No. 26,418
McDermott, Will & Emery
28 State Street
Boston, Massachusetts 02109-1775
Telephone: (617) 535-4065
Facsimile: (617) 535-3800
E-mail: tkusmer@mwe.com

CERTIFICATE OF MAILING

"Express Mail" Mailing Label Number EL 721111765 US Date of Deposit August 14, 2001

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 CFR 1.10 on the date indicated above and is addressed to Box CPA, Assistant Commissioner for Patents, Washington, DC 20231.

Cynthia Joseph
(Person Mailing)

(Signature)